Potential IP Solutions for Networking Selected FAA Weather Systems

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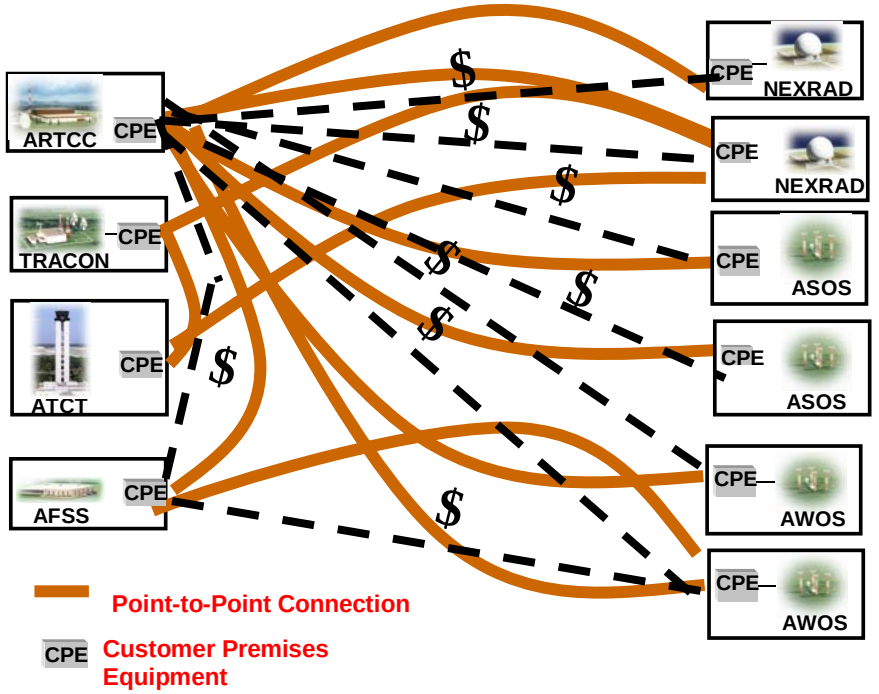
Overview

- FAA Weather Telecommunications
- FAA Weather Observation Systems
- Potential IP Solutions
- Proof of Concept Tests
- Summary

FAA Weather Telecommunications Background

- **Many weather systems are connected via point-to-point circuits today**
  - **Pricing of circuits is sensitive to the distance between endpoints**
  - **Prevents efficient use and distribution of weather data**



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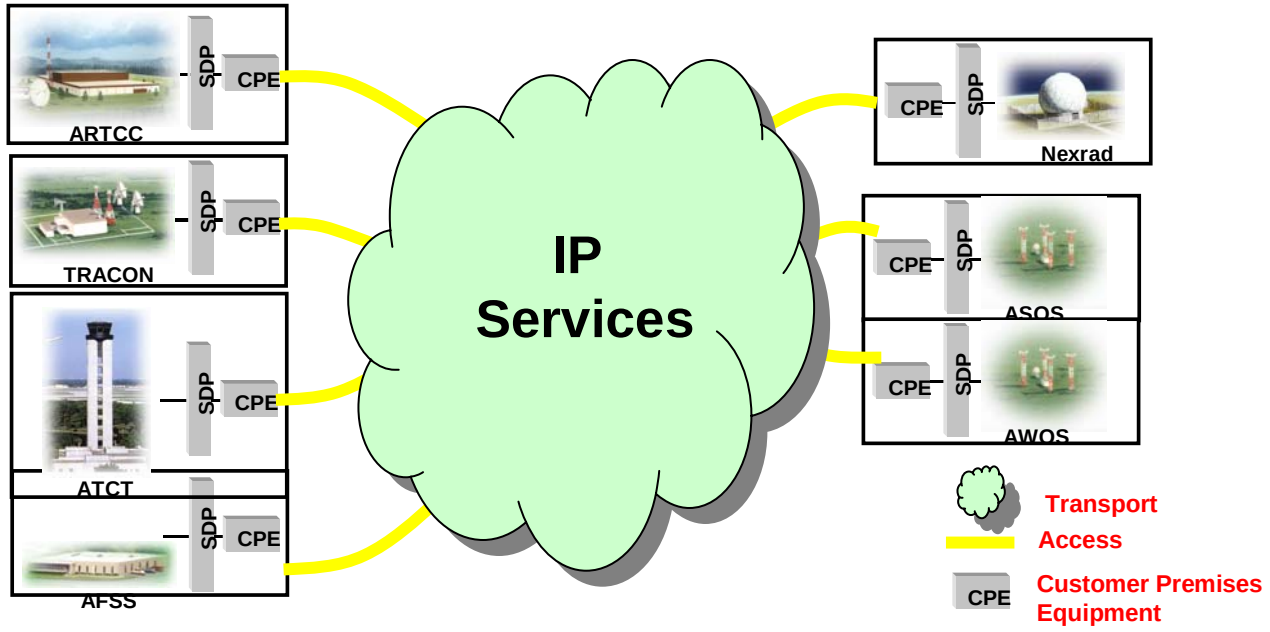
FAA Weather Telecommunications Benefits of IP

- **Internet Protocol (IP) service options for wide area network (WAN) transport will allow the agency to:**
  - **Allows better distribution of the data to users**
  - **Pricing mechanisms are typically distance insensitive**
  - **Improved troubleshooting with centralized network management**



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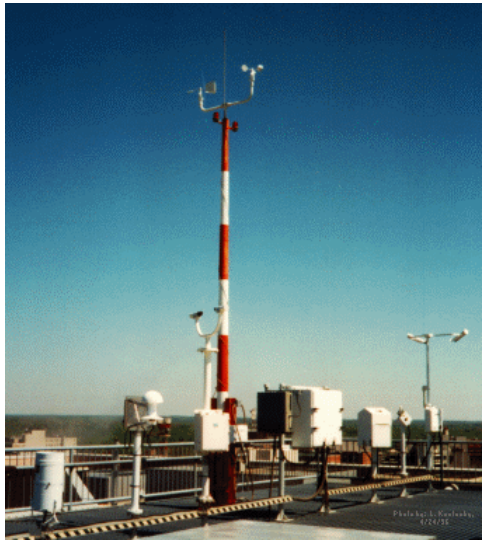
Need for Interim Solutions

- **Ideal long-term solution is to run in native IP mode**
  - **Not all weather systems will upgrade to native IP mode concurrently**
- **Interim solutions may offer benefits of IP technology during transition**
  - **Minimal investments recouped with reduced recurring costs**
- **Possible interim solutions that can be used during transition**
  - **Tunneling**
  - **Protocol Conversion**

FAA Weather Telecommunications Study Focus

- **Our weather study focused on analyzing methods for migrating sensors from the Aviation Surface Weather Observation Network (ASWON) to IP for WAN transport**
  - **Automated Weather Observing System (AWOS), Automated Surface Observing System (ASOS), Automated Weather Sensing System (AWSS)**
  - **AWOS Data Acquisition System (ADAS)**

Organization	ASWON Sensor		
	AWOS	ASOS	AWSS
FAA	160	571	15 (15 more in the future)
NWS	N/A	313	N/A



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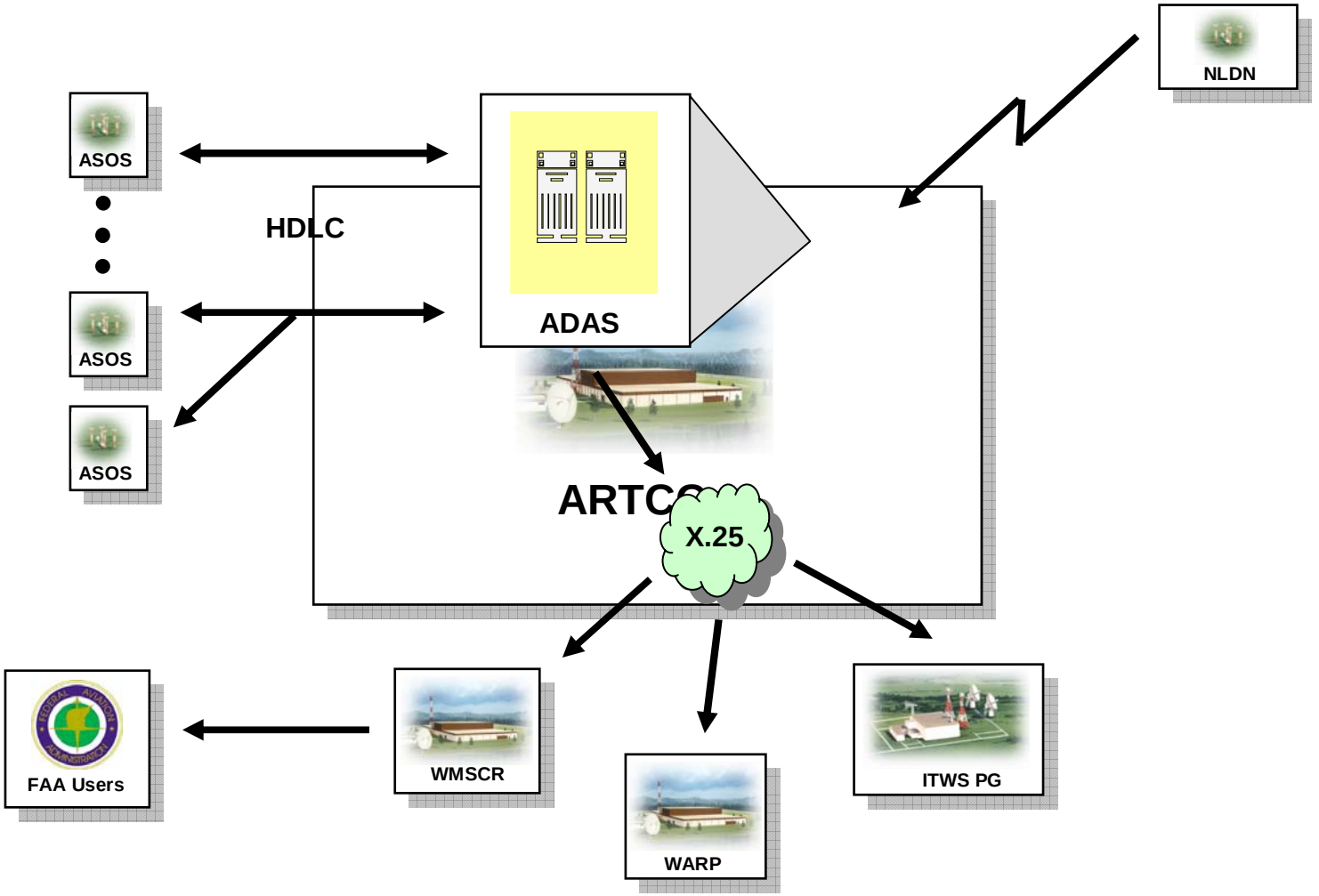
AWOS Data Acquisition System (ADAS)



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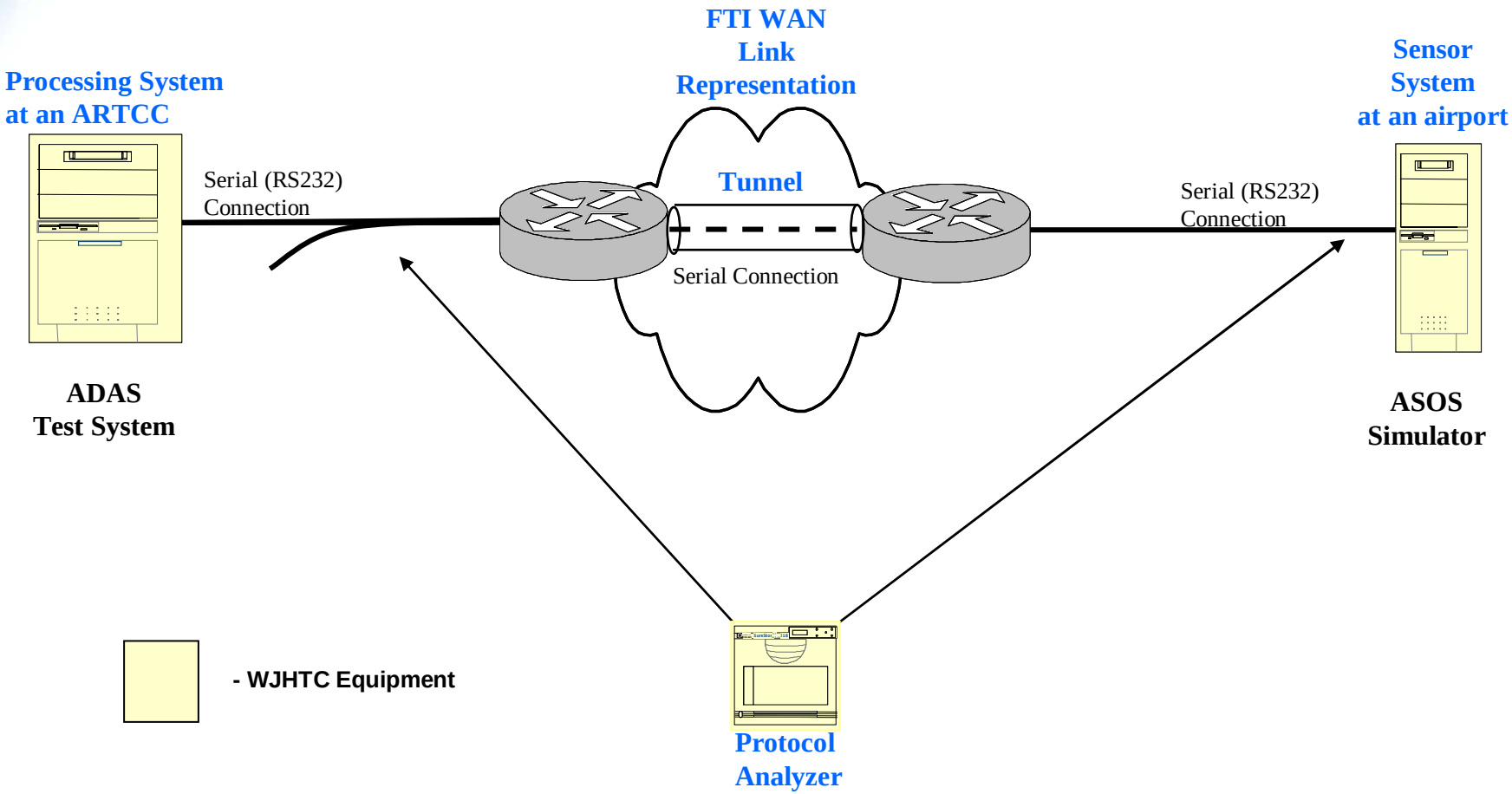
Laboratory Proof-of-Concept Tests

- **Testing conducted June-October 2004 with cognizant technical staff members at the WJHTC in NJ**
  - **Tunneling**
    - **STUN-Basic**
  - **Protocol Conversion**
    - **Serial-IP**
  - **Single-Station and Dual-Station Configuration**
- **Both tunneling and protocol conversion need to be tested with actual weather system applications and networks to determine if they are viable methods for properly transporting WX data over an IP network**

Tunneling Test Setup (Single-Station)



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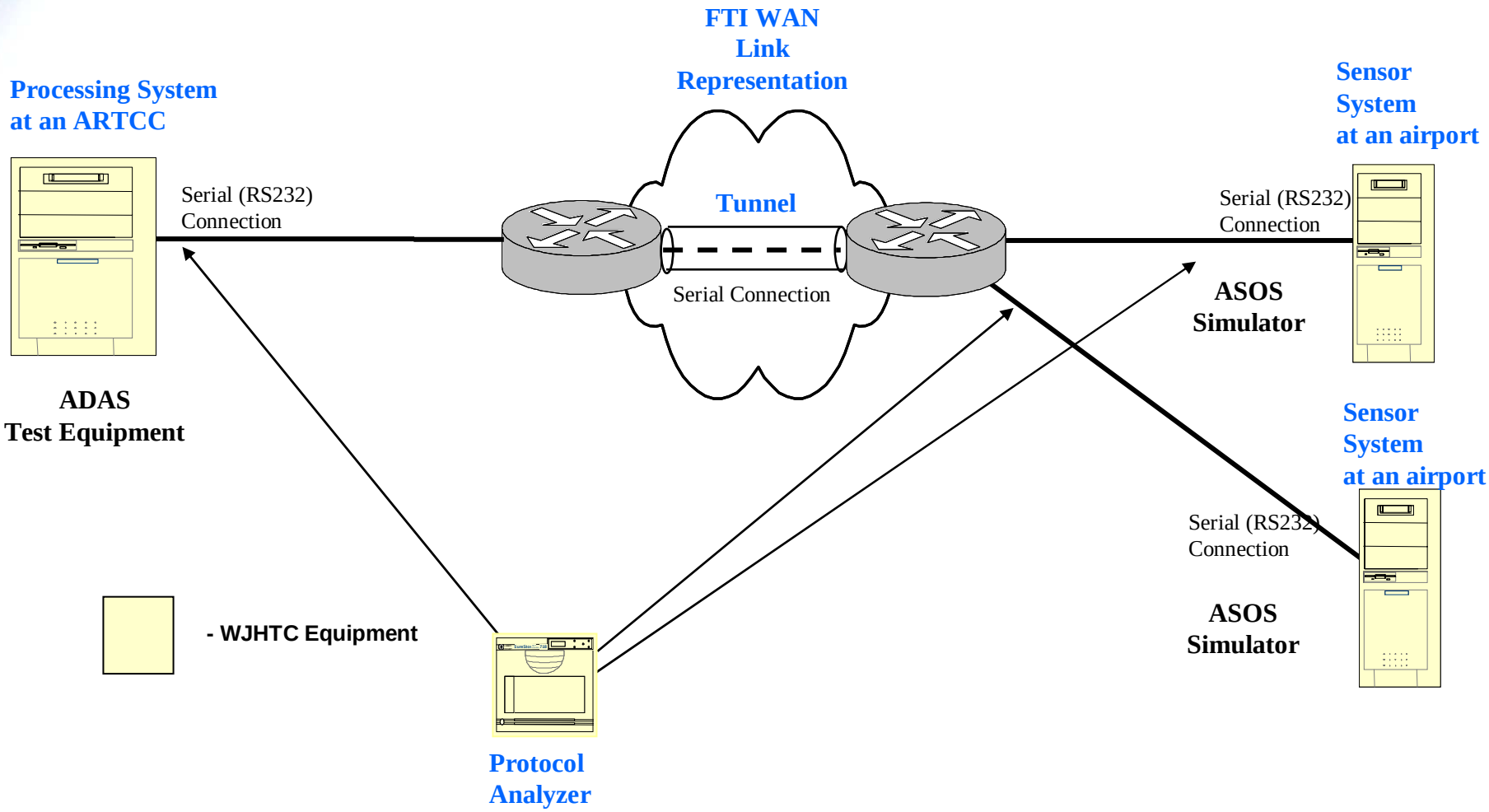
Tunneling Test Setup (Dual Station)



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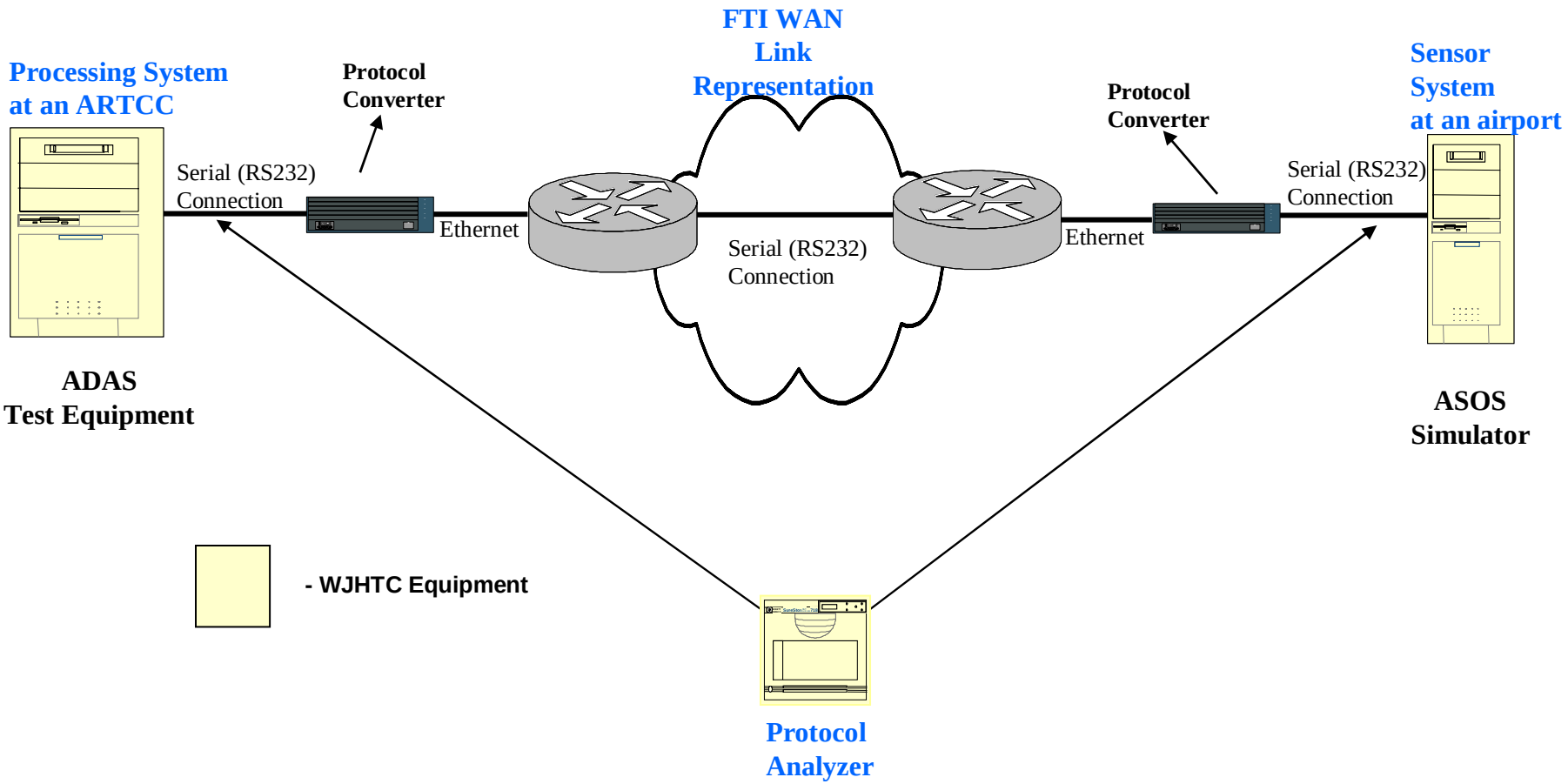
Tunneling – STUN-Basic-Test Results

- **Single Station**
  - **Request and Data frames were observed using Protocol Analyzer**
  - **ADAS and ASOS functioned properly**
  - **STUN-Basic connectivity is robust under a failure/recovery test**
- **Dual Station**
  - **Request and Data frames were observed only for one ASOS**
  - **In practice STUN-Basic could not support ADAS-ASOS multi-point communications**

Protocol Conversion Test Setup (Single Station)



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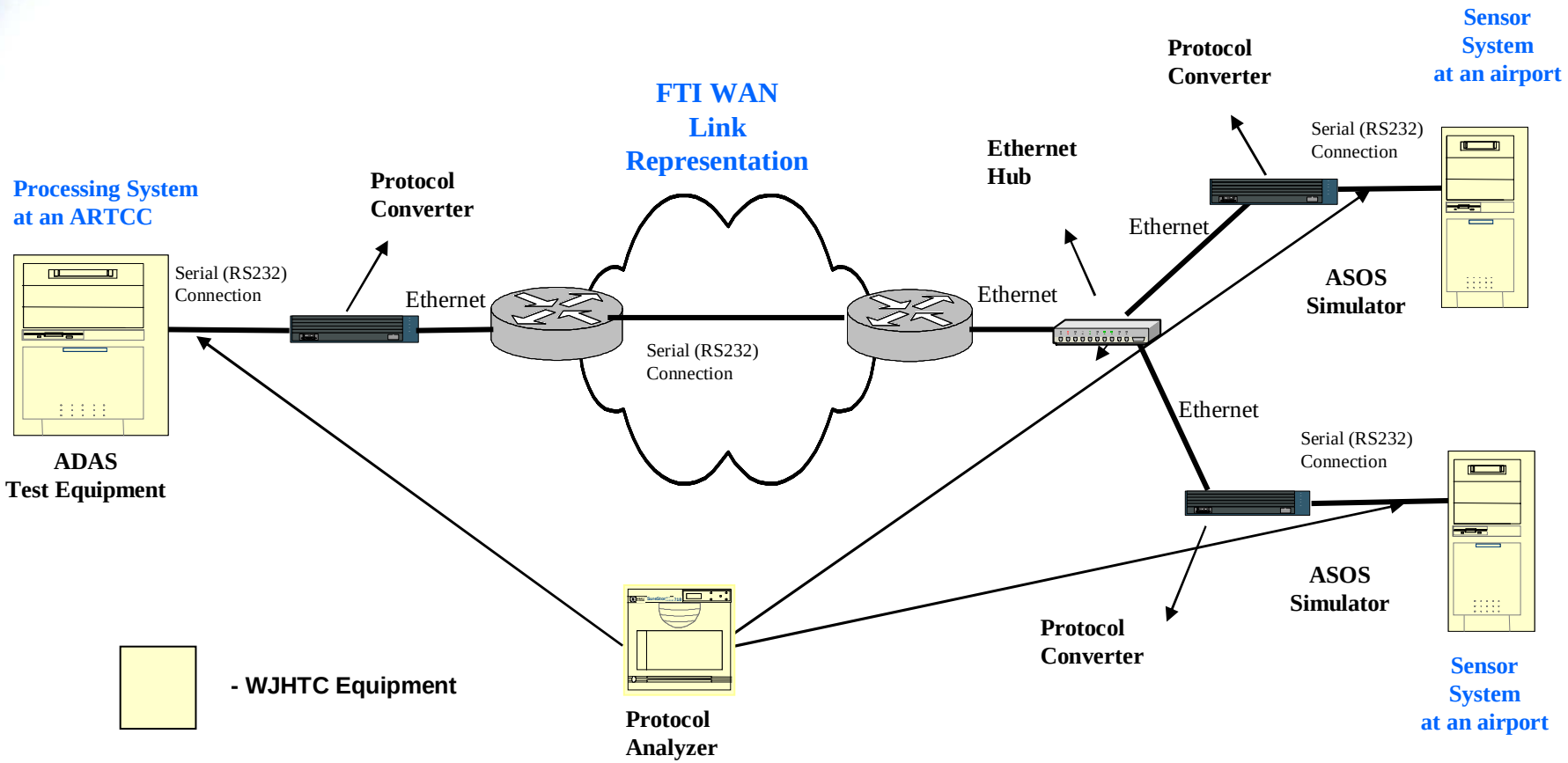
Protocol Conversion Test setup (Dual Station)



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Protocol Conversion - Test Results

- **Single Station**
  - **Basic connectivity was established**
  - **Steady increments of transmitted packets without drops and errors were observed by protocol analyzer**
  - **Failure recovery successful**
- **Dual Station**
  - **Basic connectivity was established**
  - **Steady increments of transmitted packets received from two ASOS stations were observed by protocol analyzer and protocol converter**
  - **Failure recovery successful**

Tunnel Scalability - Summary

- How many tunnels can be supported ?
  - What is impact on router performance ?
- Scalability is limited by serial port capacity on the router
  - Mid-class: 8-12 ports
  - High-end: 20-24 ports
- Simulation study shows low CPU utilization for low-bit rate tunnels
  - CPU utilization < 1% for 30 tunnels

Summary

- **Interim IP solutions may contribute to more efficient and cost effective telecommunication**

	ADAS-ASOS Point-to-point	ADAS-ASOS Multipoint	Scalability
Serial Tunnel (STUN-Basic)	Robust	Fail	Supports ADAS-ASOS
Protocol Conversion	Robust	Robust	Solution needs to be tested with more than 2 ASOS.